Pr10883 - Safety in Design Guidelines

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References	Refer to Appendix B - References

Note:

This document has been produced to provide guidance to designers in relation to safety in design.

This document should be read in conjunction with Pr8187 - Safety in Design Procedure.

It remains the responsibility of all designers to ensure that their designs are carried out in accordance with all relevant health and safety regulations and legislations in Queensland.

Contents

Section A - Guidelines ... 1

1. Objective of the Safety in Design (SID) Guidelines ... 2
2. Legal Obligations and Australian Standards ... 2
3. Benefits of Safe Design ... 2
4. Safety in Design Report ... 3
   4.1 Purpose of the Report ... 3
5. Key Persons and Responsibilities ... 4
   5.1 Project Manager ... 5
   5.2 Designer ... 5
   5.3 Contractor ... 5
   5.4 Workshop Facilitator ... 5
   5.5 Registered Professional Engineer of Qld (RPEQ) ... 6
   5.6 Who Else May Be Responsible for a Safe Design? ... 6
6. Ability to Influence Safety of a Design ... 7
7. Hierarchy of Controls with Examples of Risk Treatments ... 8
8. Overview of Safety in Design ... 9
9. Key Questions Designers Should Answer ... 10
10. Providing and Obtaining Information ... 12

Section B - Safe Design ... 13

Chapter 1. Working at Heights ... 14
Chapter 2. Working over or near water ... 17
Chapter 3. Manual Handling ... 19
Chapter 4. Electricity ... 21
Chapter 5. Confined Spaces ... 25
Chapter 6. Chemicals ... 28
Chapter 7. Working on or near Public Areas ... 32
Chapter 8. Fire and Explosion ... 35
Chapter 9. Access and Egress ... 38
Chapter 10. Machinery ... 41
Chapter 11. Cyber Security ... 43

Appendix A - Definitions ... 45

Appendix B - Reference documents ... 47

Appendix C - Attendance Resource Mapping for Workshops ... 49

Pr10883 - Safety in Design Guidelines

Section A - Guidelines

1. Objective of the Safety in Design (SID) Guidelines

This document has been prepared to provide guidance on safety in design for water and wastewater networks and wastewater treatment facilities being constructed, operated and maintained by Unitywater or their Contractors, in compliance with standards, regulatory requirements and Unitywater's safety policy.

Section B of this guideline highlights the most common causes of injury or risk of injury in Unitywater. Designers should demonstrate that they have reviewed and mitigated these risks as far as reasonably practicable.

2. Legal Obligations and Australian Standards

SID processes employed, must fulfil the requirements of statutory Local, State and Commonwealth Authorities and current applicable Australian Standards. Alternatively, where no Australian Standard exists, work must conform to the most current and applicable International Standard. Where conflict exists between different Codes, Standards or Regulations, the most onerous conditions of specification must apply unless accepted otherwise in writing by Unitywater.

The Contractor must not deviate from the provisions of the relevant Technical Specification without first obtaining agreement in writing from Unitywater. All relevant Standards, Acts, Regulations and Statutory requirements and Codes of Practice of the State of Queensland, Australia, are included in Appendix B – Reference Documents.

3. Benefits of Safe Design

Inherently safe plant and equipment would save between 5–10% of their cost through reductions in inventories of hazardous materials, reduced need for protective equipment and the reduced costs of testing and maintaining the equipment.

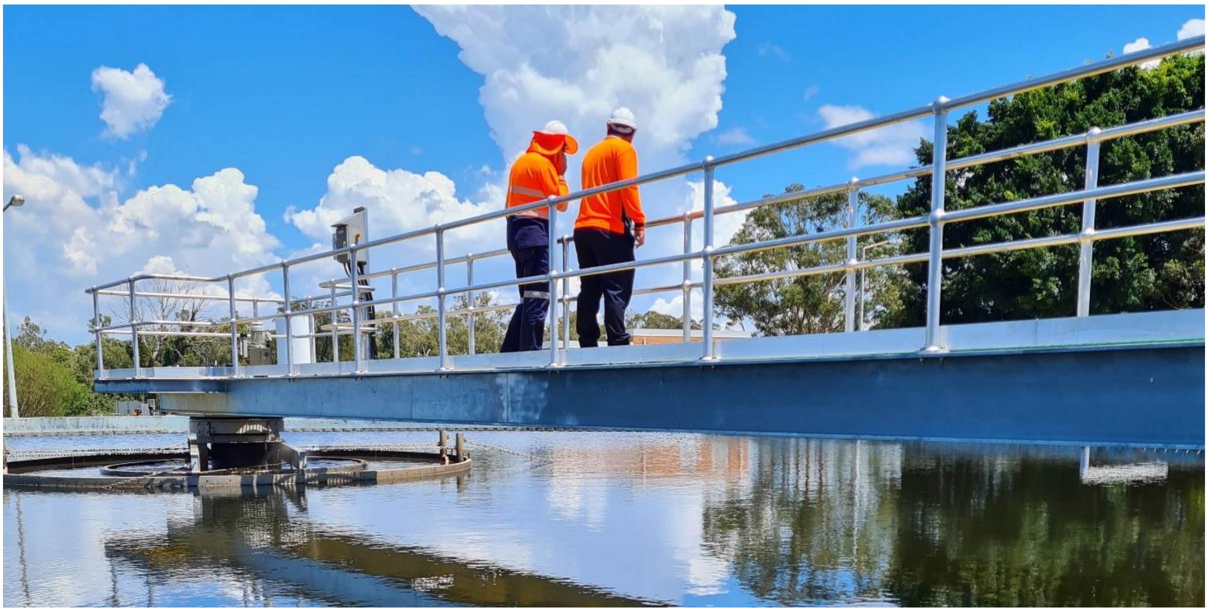


Figure 1. Decisions made during the design of clarifier walkways significantly reduce risks.

The direct costs associated with unsafe design can be significant, for example retrofitting, workers' compensation and insurance levies, environmental clean-up and negligence claims. Unitywater is the end user of these designs and assets, so the impact to Unitywater is significant. Hence, there is an enhanced ability to influence and significant benefits from employing a SID process.

A safe design approach results in many benefits including:

- the prevention of injury and disease;
- improved usability of products, systems and facilities;
- increased productivity and improved cost predictions over the product lifecycle;
- compliance with legislation and standards;
- greater innovation, since safe design demands new thinking.

4. Safety in Design Report

The Designer/Facilitator must provide a SID Report and submit the report and updated Project Risk Register (PRR) after the workshop. An executive summary, introduction and purpose must be given in the reports submitted by the contractor to Unitywater.

The executive summary of SID processes to date must highlight:

i. the level of hazard reduction by design;
ii. any risks higher than LOW recorded in the PRR that are likely to require significant scope changes or control measures with significant associated costs.

The introduction must provide a concise summary of the project, including:

i. background details, scope and applicable design and/or construct gates;
ii. contractor's SID processes and methodology adopted for the project.

4.1 Purpose of the Report

The purpose of the report is to record the hazard identification activities and findings. The intent of the hazard studies is to provide the evidence that appropriate, reliable hazard identification activities have been carried out in accordance with the relevant standard.

The SID report is to be prepared for the design of 'structures' defined under the *Work Health and Safety Act 2011* to mean anything that is constructed, whether fixed or moveable, temporary or permanent. 'Structures' includes all civil, mechanical, electrical and environmental works, whether above or below ground.

5. Key Persons and Responsibilities

There are five key roles engaged and responsible for the safe design outcomes from the delivery of Unitywater projects.

<table>
<tr><th>SID Member</th><th>Responsibilities During SID Development</th><th colspan="2">Responsibilities After SID Development</th></tr>
<tr><td>Project Manager</td><td>• Manage a fixed asset design or modification
• Select suitably qualified facilitators for hazard studies
• Ensure compliance with this guideline and SID procedure</td><td colspan="2">• Ensure all actions are completed
• Communicate lessons learned to Unitywater stakeholders</td></tr>
<tr><td>Designer</td><td>• Prepare sketches, plans, drawings
• Develop documents, directions, variations or advice
• Make design decisions that may affect health and safety</td><td>• Provide consultation on proposed alterations or modifications to a design</td><td rowspan="4">• Report to Project Manager for further directions

• Consult, cooperate and coordinate with SID team members</td></tr>
<tr><td>Contractor</td><td>• Plan and manage construction work
• Eliminate or minimise health and safety risks
• Consult with designer if undertaking design alterations to confirm changes do not affect health and safety</td><td>• Provide RPEQ certified drawings of design changes</td></tr>
<tr><td>Facilitator</td><td>• Select and use the experience and expertise of the study team to critically evaluate the design
• Brings out the views of a diverse range of people
• Keep the workshop on track by listing issues for action outside workshop</td><td>• Ensure action items are communicated</td></tr>
<tr><td>RPEQ</td><td>• Ensures compliance with the Queensland Professional Engineers Act 2002
• Performs professional engineering services</td><td>• Certify design, drawings and modifications</td></tr>
</table>

Figure 2. Responsibilities for team members performing a SID on infrastructure, facilities, plant or equipment.

5.1 Project Manager

An appropriately qualified person who has been assigned the responsibility to manage a fixed asset design or modification on behalf of (i) Unitywater or (ii) the Contractor respectively. The project manager is the single point of contact.

5.2 Designer

A person who conducts a business or undertaking (PCBU) whose profession, trade or business involves:

i. Preparing sketches, plans, drawings, documents, directions, variations or advice (verbal or written) for infrastructure, facility or equipment;

ii. Making decisions for incorporation into a design that may affect the health and safety of persons who construct, use or carry out other activities in relation to the structure.

A person conducting a business or undertaking who alters a design without consulting the original designer will assume the duties of a designer. Any changes to the design of a structure may affect the health and safety of those who work on or use the structure and must be considered by the person altering or modifying a design (Workplace Health & Safety Qld, Safe design of structures, Code of Practice 2021 and *Work Health and Safety Act 2011* Section 22).

5.3 Contractor

The Contractor has duties to confirm that the construction work is planned and managed in a way that eliminates or minimises health and safety risks so far as is reasonably practicable.

The Contractor may also be a designer if they undertake design work or if they alter or modify a design without consultation with the original designer. Design changes must also be certified by RPEQ and the Contractor must confirm, in the SID Report, that any changes they make to the design does not create additional risks to health and safety.

5.4 Workshop Facilitator

The workshop is performed by a group of people who are involved in the design and construction of the project. The composition of the team being dependent on the scope and nature of the design under review. Refer to Appendix C of this Guideline for a resources map for different SID workshops.

It is recommended that the facilitator should have the following attributes:

- a facilitator that is independent and not involved or connected with the design of the specific project, in any way;
- an understanding of the principles of SID and construction alongside a broad understanding of the project;
- an ability to facilitate workshops to constructively challenge the design concept.

The facilitator nomination must be accepted, by the Unitywater Project Manager, before a SID workshop begins. The facilitator must be able to demonstrate knowledge and capabilities in all the specific fields related to the project including the following minimum categories:

- workplace health and safety legislation, codes of practice and regulations;
- scope of works of the project and intended use of the works;

- risk assessment and risk management procedures;
- requirements around asset isolation, double isolations and shutdowns;
- commissioning and process proving;
- operational and maintenance requirements;
- decommissioning and putting 'in care';
- literature and relevant data on human dimensions, capacities and behaviours.

5.5 Registered Professional Engineer of Qld (RPEQ)

All workers and Contractors performing work related to Unitywater assets shall comply with the Queensland *Professional Engineers Act 2002* (PE Act):

- professional engineering services for Queensland are required to be carried out by a registered professional engineer of Queensland (RPEQ);
- a person can carry out professional engineering services for Queensland whilst unregistered if they are carrying out the services under the direct supervision of a RPEQ who is responsible for the services.

A professional engineering service is defined as a service that requires, or is based on, the application of engineering principles and data to a design, or to a construction, production, operation or maintenance activity, relating to engineering.

The requirement for RPEQ is not limited to design. Final design documents are to include a record of the RPEQ responsible for the work.

The Board of Professional Engineers of Queensland (BPEQ) regulates the profession of engineering in Queensland. The main function of BPEQ is the administration of the PE Act and managing the RPEQ system. Refer to the *Professional Engineers Act 2002* and the *Professional Engineers Regulation 2003* on the BPEQ website (http://www.bpeq.qld.gov.au).

5.6 Who Else May Be Responsible for a Safe Design?

Whilst the ultimate responsibility rests with the RPEQ, achieving safe design is also the responsibility with any other groups or individuals (stakeholders) who control or manage design functions. This includes:

- architects, industrial designers or draftspersons who carry out the design on behalf of a client;
- any stakeholders who make design decisions during any of the lifecycle phases such as engineers, manufacturers, suppliers, installers, builders, developers, project managers and WHS professionals;
- anyone who alters a design;
- building service designers of fixed plant such as ventilation and electrical systems;
- Suppliers who specify the characteristics of products and materials such as masonry blocks and by default decide the weights bricklayers must handle.

Safe design can be achieved more effectively when all the parties who control and influence the design outcome collaborate on incorporating safety measures into the design.

6. Ability to Influence Safety of a Design

SID is most effective when applied at the earliest stage of the design process. As shown in Figure 1 below, there is a direct link between the cost and difficulty of implementing controls and the stages of the project life cycle. The most cost-effective safety controls are applied between the concept and detailed design stages. As the project progresses towards construction and operation, these safety controls become more difficult to introduce and more costly.

The SID Report shall be prepared and maintained as a live document during the design and construction phase of the project. Tools such as Hazard Identification (HAZID) Hazard Operability (HAZOP) study, Control Hazards and Operability Analysis (CHAZOP) and Construction Hazard Assessment Implication Review (CHAIR) can be used to conduct detailed hazard identification and risk analysis.

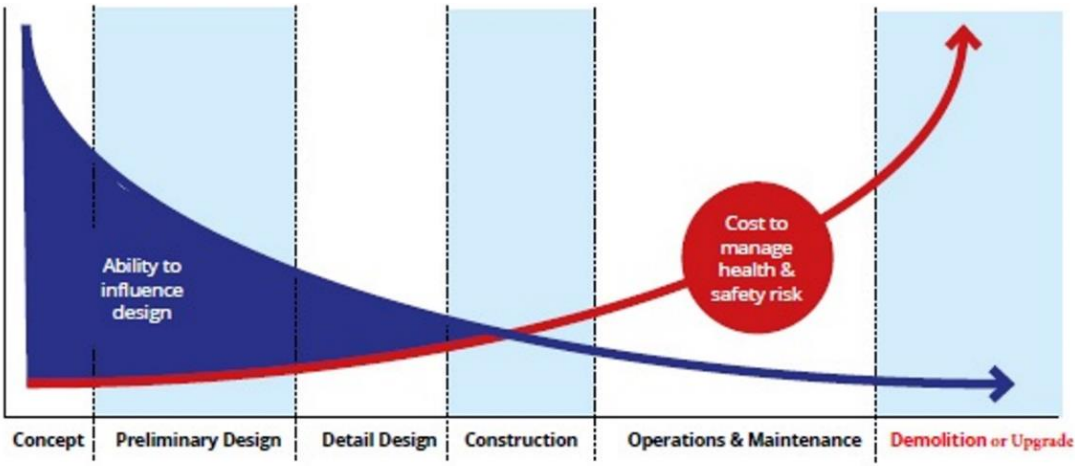


Figure 3. Ability to influence safety outcomes over lifecycle of asset.

7. Hierarchy of Controls with Examples of Risk Treatments

Implement the hierarchy of controls (Figure 4) during design. Some activities require specialised PPE, such as confined space works, work at heights, welding and spray painting.

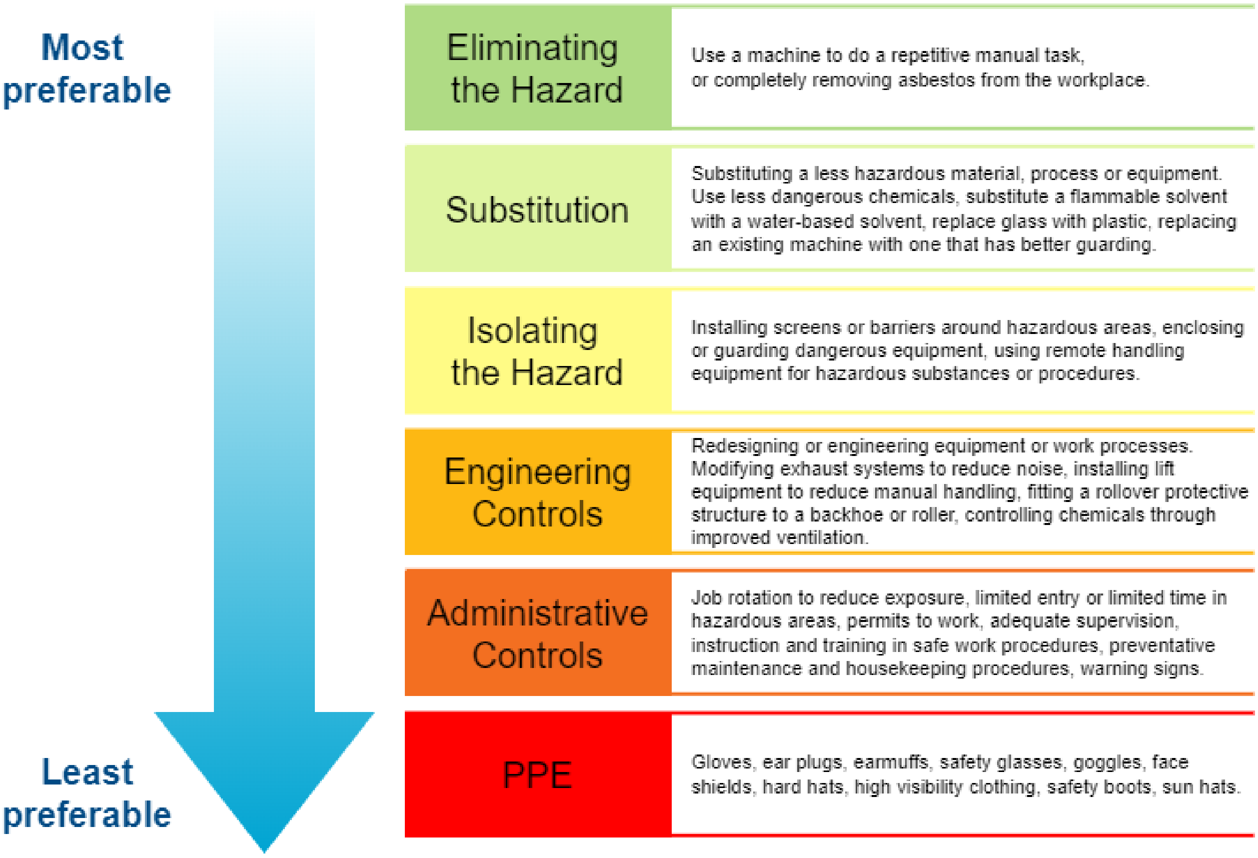


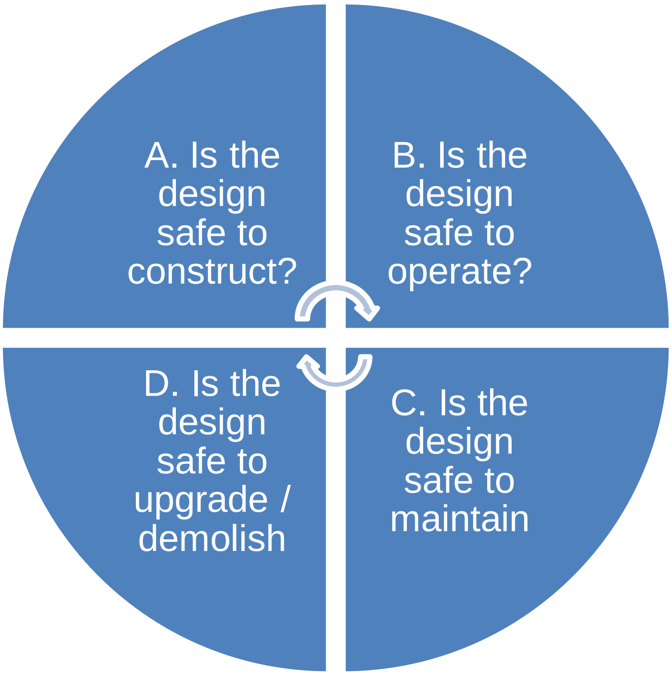
Figure 4. The hierarchy of controls.

8. Overview of Safety in Design

The Designer must demonstrate that they have undertaken a preliminary safety review prior to the formal SID workshop to ensure that the standard safety concerns are eliminated.

Figure 5. SID pathways define how to support team members in the delivery of safer design outcomes.

9. Key Questions Designers Should Answer



A Is the design safe to construct?

Design mitigation measures relating to construction:

- re-routing existing utilities cables before construction begins;
- considering the use of offsite construction (prefabrication) to reduce risks such as fall from height during construction;
- designing traffic areas to separate vehicles and pedestrians;
- adequate access for delivery of construction material and plant to the site, including areas for laydown and crane positioning;
- limiting the size of prefabricated components destined for areas with restricted access;
- resolving issues, such as electrical power supply, presence of confined spaces and liquid flows issues, so that new works can be carried out safely while the existing site remains operational;
- ensuring that all design stakeholders (including structural, architectural, mechanical, electrical, process) are invited to the SID workshop and coordinated to provide integrated solutions.

B Is the design safe to operate?

Consider the operations of the asset, including the likely systems of use, and the type of machinery and equipment that may be used. Risks relating to the operation and maintenance of assets can be addressed by designing for:

- access for maintenance purposes, such as a fixed ladder with a fall arrest system;

- non-slip materials on floor surfaces in areas exposed to the weather or wet areas;
- enough space, suitable lighting and lifting gear within the facility;
- structures and functions that eliminate the need to enter confined spaces or work at height;
- remote isolations for all electrical equipment with a high risk of arc flash;
- spaces in which workers can use mechanical plant or tools to reduce manual handling;
- effective noise barriers and acoustical treatments to walls and ceilings;
- floor loadings to accommodate heavy machinery used in the structure;
- operation manuals that are comprehensive and understandable to enable safe use of designed accessways, access systems and their components;
- clear indicators of the design loads for different parts of the facility on drawings;
- specific task demands and considering for potential future use;
- installation measures to prevent exposure to harmful gases or chemicals;
- suitable barriers to prevent falls into water, such as aeration ponds and tanks.

C Is the design safe to maintain?

Risks relating to cleaning, servicing and maintaining an asset can be addressed by:

- designing the structure to eliminate maintenance of equipment at height;
- eliminating or minimising the need for entry into confined spaces;
- designing safe access (i.e. fixed ladders with fall arrest system) and enough space to complete structure maintenance activities;
- using long-life components, such as lights, that do not require frequent replacement;
- using durable materials that do not need to be re-coated or treated;
- designing features to avoid dirt or moisture traps;
- designing and positioning permanent anchorage and hoisting points into structures where maintenance needs to be completed at height;
- ensuring installation location is suitable and easily accessible for maintenance tasks.

D Is the design safe to remove / demolish / upgrade?

To ensure that asset can be upgraded or decommissioned safely, the designer should provide information that:

- describes features that have unusual construction, demolition techniques or sequencing;
- relates to potentially hazardous components or substances;
- assists the Constructor in understanding the design requirements and their assigned scope of work.

10. Providing and Obtaining Information

Provide information about a design so that persons constructing, operating, maintaining, upgrading or decommissioning their design can fulfil their responsibility safely. Ensure that the information regarding a design is communicated and coordinated with other designers. This allows designers to take each other's designs into account and address all potential risks.

Designers should be satisfied that they have all the required information to design safely for the whole lifecycle of an asset. This information includes:

- defined design scope;
- environmental, client and planning restrictions;
- site investigation information and the location of existing services;
- existing drawings and survey information;
- information regarding future use and maintenance;
- existing risk register.

Section B - Safe Design

Chapter 1. Working at Heights

Most serious and fatal falls are from roofs, ladders or scaffolds – and from a height of between 2.1 and 4 metres. Always consider alternatives to working at heights during the design phase.

What is working at height?

Work at height means working in a place where a person could be injured by falling from it, even if it is at or below ground level. Examples of working at height include:

- accessing water reservoirs by fixed ladders where a person can fall >2m;
- accessing open pits and wells where a person can fall > 2m;
- accessing an excavation or trench where a person can fall >2m;
- working from mobile plant - elevated work platform or cherry picker;
- working on top of (empty) process tanks;
- accessing maintenance holes and valve chambers.

Designers should consider the hierarchy of controls methods such as:

1. Eliminate working at height

Designers should consider:

- whether work can be managed at ground level, i.e. placing equipment the ground rather than on roofs or at high level;
- selecting equipment that can be lowered down from height by mechanical means and maintained/worked on at ground level.

Designers should ensure, so far as is reasonably practicable, that any work involving the risk of a fall by a person from one level to another is carried out on the ground or on a solid construction platform.

2. Reduce the risk of injury arising from working at height

Where equipment or elements of plant are required to be installed at height, consider:

- safe access means for personnel;
- permanent access platforms designed to the required codes;
- obstacle free and non-slip surfaces;
- consider the local environment in the water/wastewater facility (e.g. presence of water);
- provide safe means of access to and egress from the workplace;
- if working from height is not avoidable, reduce the distance of a potential fall;
- reduce the height of some structures;
- equipment that requires regular maintenance should be located close to or on the ground, e.g. gauges can be placed at eye-level to eliminate the use of ladders.

3. Controlling the risk

Designers should only consider PPE as the least preferred control of the risk. If it is not reasonably practicable to eliminate the risk of a fall, then minimise the risk of falls by providing a fall prevention device or a work positioning system.

Always consider the limitations of the PPE. So, for fall-arrest systems and harnesses, consider the suitability of anchor points for inspection, maintenance requirements and serviceability.

Highlight

Stairs may be a better option to increase safety, in comparison to ladders stairs.

Eliminate the Hazard
If ladders are not required, then remove them. Select locations for access to heights. Do instruments need to be on roofs or at height? For this reservoir and tank, yes.

Figure 7. Ladders provide access to roofs, equipment, and instruments.

Reduce Risk
Ladders with enclosed cages are not recommended. Roofs, equipment and instruments be specified as requiring only infrequent maintenance.

Control Risk
Develop a detailed and well managed procedure for accessing roofs for maintenance, including safe systems of work.

Chapter 2. Working over or near water

Wherever there are water-filled structures, there is a risk of drowning or other water related injuries. It is imperative for all projects to eliminate or safeguard against construction team members or operators falling into or being encapsulated by water containment structures.

What is working over or near water?

Working over or near water means exposing persons to a risk of injury or drowning in a body of water or liquid.

Table 1: Examples of working over or near water.

Reservoirs	Lagoons	Maintenance holes and chambers	Bioreactor
Channels	SPS wet wells	Final settling tank outfall and weir	Other process units

Designers should consider the hierarchy of control methods such as:

1. Eliminate working over or near water

Considering the nature and distribution of the business and assets, total elimination of the hazard is unlikely. However, some elimination approaches include:

- construct structures away from water or dewater the area of construction;
- if assets require regular interaction with persons, then locate them away from water;
- consider the use of technology for sampling and monitoring.

2. Reduce the risk of drowning and injury from working over or near water

There will always be an element of working over or near water due to the requirements of water and wastewater sites. Consider making the interaction between persons as safe as possible, at all stages in the lifecycle. This includes:

- specifying low or no maintenance equipment for use within water bodies;
- providing safe access to the water's edge, e.g. handrails, safety nets;
- designing suitable rescue and recovery systems;
- systems in water that are removable or retractable at a safe distance;
- designing systems that can be remotely monitored.

Consider collective means of protection to reduce the risk of drowning. Examples of collective measures include edge protection, enclosing tanks and chambers, placing maintainable items away from the water's edge.

3. Controlling the Risk

PPE and flotation devices are useful but should only be incorporated after all other measures have been exhausted to eliminate the risks associated with working over or near water. When considering the use of PPE or flotation devices, such as lifejackets or rescue buoys, designers should consider the limitations of PPE. These include the maintenance, serviceability, access and suitability of the equipment in its intended environment.

Ensure that the placement of PPE does not provide a false sense of safety, e.g. wearing of steel capped gum boots should not be encouraged around water filled containers, rescue buoys around bioreactors do not guarantee flotation assistance.

Highlight

Applying SID principles to sewage treatment plant process units has led to many well-designed handrails that limit access to work over water.

Eliminate the Hazard

The hazard of working near water cannot be eliminated in the case of clarifiers at STPs.

Figure 8. Only limited interactions are performed on the path beside this clarifier.

Reduce Risk

The risk is greatly reduced by the presence of the handrail. Design the handrail to be located directly between persons and the water.

Figure 9. Handrails around clarifiers reduce the risk of working near water.

Control Risk

Work must only be performed on the correct side of the handrail. At clarifiers, provide floatation devices in clear view.

Chapter 3. Manual Handling

Manual handling is a high risk setting for many industries. Manual handling injuries can be greatly reduced by following correct procedures that are well publicised. Designers must consider all known injury reducing procedures during the relevant design phases.

What is manual handling?

Manual handling refers to the use of an individual's physicality to lift, lower, carry, push or pull an item. When manual handling is carried out incorrectly, it can lead to a variety of musculoskeletal injuries in the affected personnel, e.g. a strained back.

Examples of manual handling in Unitywater:

- lifting of maintenance hole, chamber covers and grills;
- handling / lifting pipework and associated equipment, such as valves;
- lifting of chemical drums;
- lifting of dosing or sampling equipment;
- manual lifting of heavy items during the construction phase;
- manual lifting of equipment during operations/planned/reactive maintenance activities;
- cable installation.

Designers should consider the hierarchy of control methods such as:

1. Eliminate Manual Handling

Elimination can be achieved by designing / specifying materials/ elements that are capable of being lifted only by mechanical means. When considering the operational and maintenance stage of the asset lifecycle, the designer should consider designing in roll-out shelves or lifting aids, such as self-lifting struts on covers, or automated dosing and sampling systems.

2. Reduce the risk of Manual Handling injury

If the risk of manual handling cannot be eliminated, limit the amount of manual handling interactions needed in the design at all stages in the element's lifecycle. There is no "safe load" regarding that a person can safely lift, as it is reliant on several factors such as age, physical fitness, existing medical conditions or environmental risks such as weather.

To prevent the risk posed by manual handling, consider the following elements of risk management:

- reduce the weight of items to be handled;
- reduce the amount of manhandling required;
- design in mechanical lifting aids such as opening struts;
- design in provision for mechanical lifting, such as adequate room and lifting eyes;
- design or specify items that can be safely handled in the construction phase;
- ensure there is space around and above the item to allow clear lifting access;
- avoid placing lifted items in awkward corners or inaccessible places, which will make the items more difficult to lift.

Highlight

Equipment location selection has delivered benefits to crews doing manual handling.

Eliminate the Hazard

Large variable speed drives (VSD) typically weigh more than 40 kg. Eliminate manual handling by not placing VSDs inside switchboards.

Figure 10. VSDs inside switchboards need 2 persons to manually lift and manoeuvre.

Reduce Risk

Reduce the need for manual lifting. VSDs can be mounted externally to switchboards to allow for the use of portable lifting gear during repairs and replacement.

Figure 11. VSDs mounted on a wall can be lifted with a crane inside the switch room.

Control Risk

Provide training in the safe use of lifting gear and manual handling procedures to relevant crew members.

Chapter 4. Electricity

The risks posed by electricity are present on many projects and sites. Always consider the risks associated with electricity in designs and remember that there is no safe voltage.

What is working with electricity?

The main hazards with electricity are:

- water contact and ingress into electrical systems and equipment;
- contact with live parts causing shock, burns and death;
- arc flash and faults causing injury, fires and damage to plant;
- fire or explosion, where electricity could be the source of ignition in a potential flammable or explosive atmosphere.

Table 2: Examples of electricity in the water industry:

Underground cables	Panels and controls	Emergency/temporary generators
Overhead services	High voltage equipment	Supply to plant, equipment and lighting
Internal cabling	Green pillar boxes	

Designers should consider the hierarchy of control methods such as:

1. Eliminate interaction with electricity

These approaches limit interaction with electricity:

- design elements that do not require persons to work with or near electricity;
- design double isolation allowances where practical and safe to do so;
- design the location of cables both above and below ground to minimise the long-term risk of interaction with the cables. Buried cables should not be in areas where future works are planned, creating dedicated underground corridors for electrical cabling;
- design out the need for electricity in locations where there is an environmental risk such as a water ingress or an explosive atmosphere;
- providing arc fault contained enclosures;
- providing remote operation of electrical equipment (i.e. SCADA, pushbutton stations).

2. Reduce risk of injury from electricity

Consider the following collective means of protection to reduce the risk:

- ensure all live electrical parts, busbars and cable termination points are securely protected against access;
- always ensure there are physical barriers that prevent direct access to electricity;
- routing cables of similar voltage in a logical controlled way, i.e. in a cable tray or service trench, and highlighting routes both on drawings and visually on site;
- due to the nature of the water environments in which electrical equipment will be utilised, designers should consider the water / weather proofing requirements;

- providing a verified switchboard design to the relevant standards;
- ensuring equipment meets HA requirements and HA dossiers are updated;
- using circuit breakers instead of isolators for switchboard protection;
- using extra low voltage for control circuits and instrumentation;
- mechanical or electrical interlocking;
- provide separate compartments for LV and ELV equipment.

3. Control risk of injury from electricity

Consider making the interaction between persons and electricity as safe as possible by implementing the following measures:

- for works on existing sites, identify all services likely to cause risk for construction;
- if cables are found to be in the path of construction or if there is an elevated risk of striking the cable during the works, then divert the cable prior to the main works starting or change the design to avoid disturbing the cables;
- ensure safe access and isolation of electrical for future operation and maintenance;
- give enough room to work on panels and spare capacity in ducts/cable trays for future;
- ensure all electrical items are clearly identified both in drawings and visually on site by signage/tags/labels;
- provide switchboard locks that only competent and qualified workers can access;
- refer to the standards and specifications in Appendix B for more understanding.

In explosive environments, ensure the design incorporates the hazardous areas requirements and the design is safe in all phases of the lifecycle of the asset. Consider the following additional control measures:

- containment of cables in ducts or cable tray;
- labelling of switchboards, equipment, cables and panels;
- designing systems that are lockable and secure;
- systems that are suitable for the operational environment and meet the design life;
- designing systems for safe isolation and maintenance.

Highlight

Separation of infrastructure from overhead power lines is key to successful SID.

Eliminate the Hazard

Avoid accidental contact with powerlines by placing infrastructure well away from overhead lines. Talk to truck drivers about how to work safely around powerlines.

Figure 12. The pumps in this well can only be safely lifted after Energex has attended and isolated the overhead lines.

Highlight

Eliminate ELV tasks being performed in proximity to higher voltage components and cables.

Eliminate the Hazard
Designate a switchboard compartment as only extra low voltage (ELV) to ensure segregation of components. Design future capacity and efficient, simple cable routes.

Figure 13. These ELV components (top right) should be segregated from 3 phase power.

Reduce Risk
Reduce exposure by limiting the quantity of cables and access to components. In explosive environments, follow hazardous areas requirements and select intrinsically safe equipment.

Figure 14. A laptop plugged into a control system in an ELV compartment.

Control Risk
Govern safe systems of work on site. Implement lock out tag out procedures.

Chapter 5. Confined Spaces

From potentially toxic atmospheres to physically hazardous conditions such as extreme temperatures, unstable materials, or the potential for falls, confined spaces often present unseen challenges. Not all employers and operators understand what constitutes a "confined space", nor the dangers associated with working in such environments.

What is a confined space?

A confined space refers to any place which by its enclosed nature, creates conditions that give rise to a likelihood of an accident, harm or injury. This includes any vessel, tank, container, pit, bund, chamber or cellar. Confined space incidents require emergency action due to the presence or reasonably foreseeable presence of:

- a flammable or explosive atmosphere;
- harmful gas, fume or vapor;
- free flowing solid or an increasing level of liquid;
- excess of oxygen;
- excessively high temperature;
- the lack or reasonably foreseeable lack of oxygen.

Table 3: Examples of confined spaces in the water industry.

Deep excavations	Large diameter pipes	Maintenance holes and chambers	Reservoirs
Sumps and wells	SPS chambers, wet wells	Pits for cables and plant	

Designers should consider the hierarchy of control methods such as:

1. Eliminate confined space entry

The need for confined space entry at all stages of the life of an asset can be eliminated by:

- using open-topped bunds instead of enclosed tanks;
- deploying in-situ sampling or monitoring devices;
- deploying in-situ cleaning systems;
- locating pipework and valves at surface level;
- incorporating vision panels or portholes to allow inspection without entry;
- designing roof or wall panels with a removable access hatch.

2. Reduce risk of injury from confined spaces

It is important to reduce the risk for confined space entry for all stages of the lifecycle of an asset, including operation and maintenance. Refer to the *WorkSafe QLD Code of Practice for Working in Confined Spaces*. Multiple means of protection are available that collectively reduce risks. The main means are:

- ensure there is ease of entry and exit to the space;
- install lockable doors, hatches or covers that are clearly labelled as confined spaces to prohibit unauthorised access;
- install devices to sample the atmosphere without entering or opening the space;
- design confined spaces that allow for the removal of persons in an emergency.

If recovery is by means of a winching and harness system, then make provision for a suitable point to attach the winch, such as a davit system or a lifting eye. Consider the available room around the outside of the space for the setup of rescue arrangements.

3. Control the risk for persons who are required to work in confined spaces

Specific requirements are set out in detail in the *WorkSafe QLD Code of Practice for Working in Confined Spaces*. The required procedures for entry into confined spaces describe the following elements:

- hazard identification, e.g. the activity that is planned in the confined space, such as welding or cleaning, and whether that activity itself generate fumes or vapours;
- competence, training, supervision and suitability of team mebe;
- permit to Work procedure and Safe Work Method Statement;
- gas purging, ventilation and respiratory protective equipment;
- testing and monitoring of atmosphere;
- mechanical, electrical and process isolation;
- alternative access and egress where possible and an emergency rescue plan.

Highlight

Typical reasons for confined space entry are to perform maintenance and inspections. Good SID outcomes can make these reasons unnecessary.

Eliminate the Hazard

Provide vision panels for inspection. For the purpose of unblocking a confined space, suggest the installation a CCTV / rodding / jetting door that prevents human access.

Figure 15. Ensure scaffolds, signs, rescue kits and davits can be set up at entrances.

Reduce Risk

Design spaces that do not require person-entry and do allow maintenance to be performed from outside. Select equipment that are retractable from the space. Design to minimise the risk of blockage or build-up of materials within the space.

Control Risk

Ensure that the space is designed so that equipment can be used properly, and the requirements set out in the Code of Practice can be implemented safely and easily. Install signage and safety systems to ensure that confined spaces are clearly identified to all workers.

Chapter 6. Chemicals

The use of vast quantities and multiple variations of chemicals within the industry increases injury risks to every employee and the general public. Therefore, it is imperative that every SID addresses efforts to reduce chemical risks in transportation, delivery, storage and usage.

What is a chemical hazard?

A hazardous chemical can be a solid, liquid or gas. It can be a pure substance consisting of one ingredient, or a mixture of substances. Exposure to chemicals in the workplace can cause acute or long-term detrimental health effects.

Chemical risks can be present at all or at different times in the design lifecycle such as construction in a live wastewater environment or dosing chemicals during treatment or carrying out maintenance on treatment plant. Examples of chemical risks in the water industry are:

- applying chemical treatments such as waterproofing during construction;
- dosing of chemicals during the operational phase;
- cleaning using chemicals during maintenance.

Designers should consider the hierarchy of control methods such as:

1. Eliminate exposure to Chemicals risk

Eliminating the need for using chemicals in all stages of the lifecycle of an asset is beneficial. One approach is to specify water-based treatments rather than solvent based treatments. It is likely that chemical risks will always be present in the water industry. Therefore, the design should allow the use of the least hazardous chemicals that can provide the required result.

2. Reduce risk of injury from Chemicals

Reduce personal interaction with chemicals by:

- using remote or mechanical means for cleaning and unblocking screens;
- automating the handling and dosing of chemicals in the system
- designing chemical storage areas to store the specific chemicals in use and employing:
  - sealed/bunded storage to allow safe recovery of accidental spills
  - chemical tanks are made of adequately resistant material, overfilling can be reliably prevented, leaking liquids are safely collected in bunds
- providing safe and lockable security cabinets at laboratories and workshops for storage of small quantities of combustible, fire-assisting, toxic or corrosive hazards;
- making provisions to prevent environmental impact in the event of leakage;
- accommodating safe separation of non-compatible chemicals;
- apply chemical treatments off site in controlled environment during the construction;
- design in ventilation and/or extraction;
- allow for storage areas of PPE and decontamination areas local to the hazard;
- providing SCADA alarms and safety shutdown systems.

3. Control the risk for exposure of persons to Chemicals

Only rely on PPE to control risk as a last resort. The use of PPE, such as gloves, chemical suits, facemasks and breathing apparatus, should be in accordance with the advice of the chemical providers and industry best practice.

Schedule 11 Hazardous Chemicals

Unitywater has several facilities which uses, handles, stores or generates hazardous chemicals. These chemicals are defined in *Work Health and Safety (WHS) Regulation 2011*. The *WHS Regulation 2011* imposes requirements on Unitywater that are summarised below.

Manifest Quantity Workplaces

Workplaces that use, handle, store or generate hazardous chemicals above the manifest quantities specified in schedule 11 of the *WHS Regulation 2011* are required to notify the regulator in writing.

Notification is required:

- immediately after it is known that schedule 11 hazardous chemicals are to be used, handled or stored at the workplace or at least 14 days beforehand
- immediately after it is known that there will be a change in the risk of using, handling or storing schedule 11 hazardous chemicals or at least 14 days beforehand
- as soon as practicable after schedule 11 hazardous chemicals are no longer used, handled or stored at the workplace.

Workplaces that are required to notify as a Manifest Quantity Workplace under the *WHS Regulation 2011* must provide information under section 348 including:

- a description of the hazardous chemical related activities
- a copy of the manifest, which must be compliant with schedule 12.

This additional information can be provided using *Form 73 – Notifications of a manifest quantity workplace* to assist workplaces in making this notification to WHSQ.

Additionally, all Manifest Quantity Workplaces must submit a copy of their emergency plan which addresses incidents involving hazardous chemicals, (e.g. leaks, spills, fires and explosions) to the Queensland Fire and Emergency Services

Hazmat Box

The manifest must be kept in a place that has been agreed with the Queensland Fire and Emergency Service (QFES). QFES recommend that the manifest be kept in a red waterproof container kept as close as possible to the main entrance.

A suitable sized Hazmat Box is 400mm x 300mm x 90mm deep. The box should be signal red in colour preferably with 100mm white letters stating ‘HAZMAT’. It should be mounted securely and locked with an agreed type of padlock.

Placard Quantity Workplaces

Workplaces that use, handle, store or generate hazardous chemicals above the placard quantities specified in schedule 11 of the *WHS Regulation 2011* must ensure that a placard is prominently displayed incompliance with schedule 13.

An outer warning placard complying with schedule 13 is also required at each entrance to the workplace where emergency services may enter.

Schedule 15 Hazardous Chemicals

The operator of a proposed facility at which chemicals in Schedule 15 of WHS Regulation 2011 are likely to be present in a quantity that exceeds 10 per cent of their threshold quantity must notify the regulator of this circumstance. A notification of a proposed facility, known as a Major Hazard Facility (MHF) must include the information required by *WHS Regulation 2011 s538* with any necessary changes.

A facility that anticipates having chemicals in excess of the threshold quantity should notify in sufficient time to comply with the Regulations. For example, if the facility is at the early design stage, plans for the facility may not be accurately known. The initial notification information may simply comprise design options under consideration, indications of the number of workers and estimates of the quantities of Schedule 15 chemicals likely to be present. Dates that should be included are the:

- earliest date for the introduction of Schedule 15 chemicals
- earliest date for beneficial production
- earliest date that the facility may exceed the MHF threshold quantities.

Early notification facilitates the safety case and licensing processes.

Note that all MHF threshold quantities are in tonnes (t) and classifications are as per the *Australian Dangerous Goods* (ADG) Code, not the *Globally Harmonised System of Classification and Labelling of Chemicals* (GHS).

Highlight

SID can be helpful for ensuring chemical storage is reasonably safe for its intended users.

Figure 16. Make pressure washing the preferred option to clean equipment, rather than chemical treatments. MHL tanks (shown right) are messy, so provide splash shields.

Reduce Risk
Adequately size and layout storage areas. Provide suitable bunding to reduce the impact of spills. Segregate chemicals to prevent reactions.

Figure 17. Use automated dosing systems to eliminate human interaction with chemicals.

Control Risk
Specify clear labelling and easy availability of Safety Data Sheet and spill kits.

Chapter 7. Working on or near Public Areas

Working in parks and reserves poses a significant risk not only to persons carrying out work but also to members of the public that interact with the works.

What are public areas works?

Public works are works carried out on streets, lanes, squares, plazas, footpaths, trails, parks, open spaces, waterfronts, public transit systems, conservation areas, and civic buildings and institutions including the following examples:

- installation of water mains and associated piping in public areas;
- installation of metering and monitoring equipment in public areas;
- managing, diverting or controlling of traffic including pedestrian traffic;
- reinstatement of public work areas;
- emergency works such as leak clean-up carried out in public areas.

Examples of risks associated with working in the public areas include:

- Traffic accidents involving vehicles, pedestrians, Unitywater or other work crews, affecting members of the public and/or construction personnel;
- Clashes with existing buried or overhead services in the public areas;
- Causing traffic congestion, leading to increased pollution and detriment to residents;
- Security of the site during non-working hours.

Designers should consider the hierarchy of control methods such as:

1. Eliminate works in the public areas

Consider ways to reduce the amount of work which takes place in public areas, especially trafficked areas, for example:

- constructed elements, including pipelines, can be located away from roadways/trafficked areas;
- items that are required for regular interaction with users/operators (e.g. meters, valves) can be designed away from carriageways;
- equipment can be installed in another location that has more limited public access.

2. Reduce risk

If public works cannot be avoided, then the risk posed by street works can be reduced by:

- limiting the extent or duration of the works;
- the extent of working space required to carry out the works safely. It is also necessary to evaluate the remaining space in the public areas for existing public traffic (including pedestrian) and to liaise with the local traffic authorities accordingly;
- identifying and communicating all known existing services at the design stage;
- routing the works to avoid conflicts with existing services;
- traffic and pedestrian volumes and phasing work accordingly;
- co-ordinating installation of various services (e.g. gas/water/other) in the same project, to minimise disruption to public space;

- using ground penetrating radar and trenchless technologies rather than invasive excavation works for site investigation;
- relining existing in ground assets rather than open cut replacement.

3. Control the risk

Measures will be required at construction stage (or maintenance work, for example cleaning of drains) to control the risks. These may include:

- the safe management of traffic (including pedestrians) in the design process;
- the phasing of the works to reduce the impact on members of the public / road users;
- emergency access being maintained at all stages in the works;
- the presence of existing buried and overhead cables.

Highlight

Limiting the extent and duration of construction works to lessen public impact is good SID.

Eliminate the Hazard
Existing technologies and methods eliminate impact to traffic, pedestrians and business owners.

Figure 18. Divert pedestrians to give enough working space for construction activities.

Reduce Risk

The likelihood of conflict with existing services can be reduced by lessening the extent of earthworks.

Figure 19. Constructing pedestrian bypasses can limit public safety impacts.

Control Risk

Obtain and communicate the most up to date service drawings to identify services. Carry out condition surveys on existing buildings to help inform how to excavate without causing damage to buildings in a poor structural condition.

Chapter 8. Fire and Explosion

Fire and explosions may be a cause of injury in the water industry.

What are fire and explosion risks?

Working with flammable liquids, dusts, gases and solids is hazardous due to the risks of fire and explosion. The effects of fires or explosions can be devastating in terms of lives lost, injuries, damage to property and the environment, and to business continuity.

Designers should consider that fire and explosion risks can be present during any of the lifecycle phases. Risks are present during construction in a live wastewater environment, or when dosing chemicals into operational assets, or when carrying out maintenance on plant.

Examples of fire and explosion risks in the water industry:

- working on or near wastewater treatment where naturally occurring gases (e.g. methane, hydrogen sulphide) can build up;
- unventilated spaces, maintenance holes and chambers, allowing the build-up of gases;
- flame cutting or grinding near wastewater during construction;
- electrical fires in boards, plant, conduits, panels or motors;
- using non-intrinsically safe equipment in designated Hazardous Areas (HA);
- processes that involve breaking through the crust or solidified layer in wastewater treatment, allowing a sudden discharge of gases.

Designers should consider the hierarchy of control methods such as:

1. Eliminate exposure to fire and explosion risk

During the design phase, consider all the potential causes of fire within the proposed project. During design projects, identify potential sources, i.e. dangerous chemicals, fuels, methane gases, electrical and arc flash. These risks often cannot be eliminated from the needs of the project. Construction materials can be selected to have fire retardant properties or the need for flammable chemicals can be eliminated.

It is not possible to fully eliminate the presence of dangerous gases such as methane (which present a fire and explosion risk) in wastewater systems. Therefore, the emphasis is on risk reduction in the design of systems.

2. Reduce risk of injury from fire and explosion

There is protection to reduce the risk of exposure to fire and explosion, including the following collective means:

- ensuring the HA requirements are understood and incorporated into the design;
- specifying intrinsically safe equipment for installation in HA zones;
- introducing forced ventilation triggered by a remote atmosphere monitoring device, to prevent the atmosphere from reaching explosive levels;
- providing permanent gas warning devices;
- designing open or ventilated spaces that prevent the build-up of flammable gases or mechanically ventilated spaces with back-up systems;
- using structural measures to limit and constrain the areas at risk from explosion;

- designing out human interaction by specifying systems to:
    - automate the handling and dosing of chemicals,
    - remotely control cleaning, mixing and agitation within tanks, and
    - perform routine cleaning or unblocking.

3. Control the risk for persons who are exposed to fire and explosion risk

There are measures for controlling fire and explosion risks that can be implemented during construction, operation or maintenance. Measures include:

- the operation of the ventilation and/or extraction systems;
- suitable storage areas, bunding and containment for flammable liquids and chemicals;
- incorporating signage and warnings into the design to communicate the risk;
- remote monitoring and fire suppression systems.

Highlight

Use SID workshops to identify fire controls for chemicals, gases and gas production.

Eliminate the Hazard
Examine a process to find ways to reduce the quantity of flammable or explosive chemicals and gases. Store chemicals in open air to eliminate gas build-up.

Figure 20. Combustible diesel fuel stored in an open area away from process plant.

Reduce Risk
Give natural ventilation or remove possible ignition sources, i.e. hot surfaces or electrical. Consider the storage location of chemicals to reduce impact on property and workers.

Figure 21. Fences give separation between combustible gases and ignition sources.

Control Risk

Locate motorised plant and equipment separate from combustible materials, gases and liquids. Display suitable warning signs and labels outside of these HA zones to warn persons of the risk.

Chapter 9. Access and Egress

The safe movement of persons and vehicles around Unitywater sites, and to all parts of the facilities (including at heights) is a fundamental aspect of safety in design. Designers must consider all aspects of traffic management including access and egress from sites to eliminate any potential traffic related incidents

What are access and egress risks?

The ability of workers to enter, exit and move safely around the site is a manageable risk. Workers need to gain safe access to all parts of the plant, equipment or other elements within the site. Routes that provide access and egress should be controlled, safe, suitably constructed, kept free of obstructions and well maintained.

A significant number of accidents occur within the water industry due to access and egress issues such as slips, trips and falls. Access risks can be present at all or at different times in the asset lifecycle, including:

- construction vehicles accessing the site;
- operators accessing the top of tanks and process equipment;
- maintenance workers servicing valves and pumps in chambers or at height.

Examples of access risks in the water industry:

- build-up of algae or contaminants on walkways causing a slip hazard on outdoor walkways and platforms;
- process equipment such as pipes and trays obstructing walkways;
- headroom and clearance on access paths;
- accessibility to equipment which requires ongoing operator interaction;
- roads and parking for vehicles;
- pedestrian interactions with vehicles moving around the site.

Designers should consider the hierarchy of control methods such as:

1. Eliminate exposure to access risks

Designers can eliminate the risk posed by unsafe access by ensuring that there is safe, well designed access to all key areas. Measures can include designing well-lit and clearly marked non-slip walkways and segregation of pedestrians from vehicles. Traffic routes and thoroughfares should be laid out in such a way to prevent risks from vehicles during operation.

2. Reduce risk of injury related to access issues

Safe access routes are to be designed to allow safe access to all parts of the site, including all elements such as valves, gauges, meters, equipment, stores, etc. All workplaces should be reachable as directly and conveniently as possible.

- paths should be even and unobstructed by obstacles and trip hazards;
- open channels, conveyor belts and other obstacles should be bridged over;
- provide more than one route to the equipment;
- floor coverings, gratings, roads and paths should be non-slip and free-draining;

- fixed ladders, maintenance hole steps, staircases and platforms should be designed to meet the required codes and standards;
- access and storage must meet construction and maintenance requirements;
- pedestrian and traffic routes should be present in adequate numbers and their layout and dimensions are such that they can be safely used by pedestrians or vehicles according to their function, e.g. adequate turning areas for vehicles, suitable parking and laydown areas with segregation of pedestrians, including suitable lighting levels for works at night.

3. Control the risk for persons who are exposed to access and egress

A suitable site traffic management or site access plan should be in place.

Highlight

SID workshops have been important for developing design modifications that improve access routes.

Eliminate the Hazard
Allow vehicles to fully access and egress the site in a forward movement, rather than reverse. Separate vehicle access from pedestrian paths.

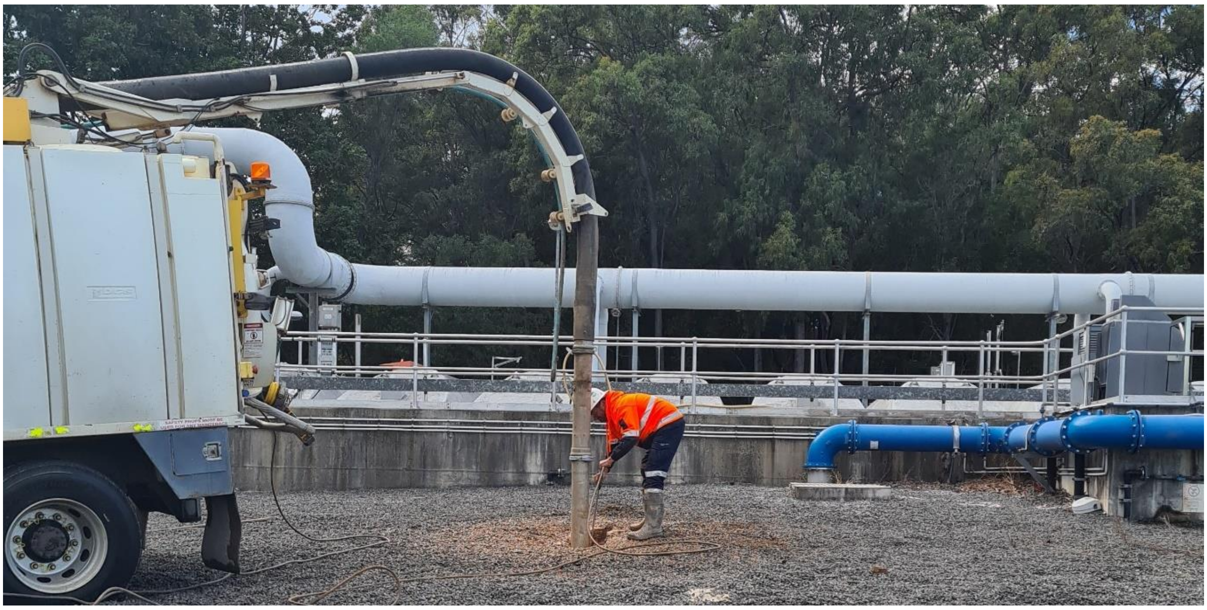


Figure 22. Pipes and conduits under gravel can be investigated when issues arise, without impacting site access.

Reduce Risk
Allow for turn-around areas up to the anticipated maximum sized vehicle and plant.
Separate machinery from pedestrian access areas.

Figure 23. Digging trenches to investigate infrastructure under hard cement laydowns.

Control Risk
Maintain an adequately sized construction zone, suitable lighting and solid barriers.

Figure 24. Soft surfaces can be problematic for trucks accessing tanks and wells.

Chapter 10. Machinery

The risks posed by many types of various Machinery are present on many projects and sites. Always consider the risks associated with machinery in designs and remember that there are many obvious and hidden dangers with all Machinery. In certain circumstances, designers and others will have to identify if there are any machinery and equipment hazards and how to eliminate or reduce the risks of those hazards causing harm.

AS/NZS 4024.1 Safety of Machinery identifies the hazards and risk arising from the use of machinery and describes methods for the elimination or minimization of these hazards and risks, as well as safeguarding machinery and the use of safe working practises. Often specific control measures will be required such as:

- Guards;
- Operator controls;
- Emergency stops;
- Warning devices; and/or
- Isolation of energy sources.

Unitywater will identify during its planning process whether a Machine Safety Workshop will have to be facilitated.

What is working with Machinery?

The main hazards with Machinery are:

- Guards;
- Operator controls;
- Emergency stops;
- Warning devices; and/or
- Isolation of energy sources.

Designers should consider the hierarchy of control methods such as:

1. Eliminate interaction with machinery

These approaches limit interaction with machinery:

- design elements that do not require persons to work with or near machinery;
- design double isolation allowances where practical and safe to do so;
- design out the need for machinery in locations where there is an environmental risk such as a water ingress or an explosive atmosphere.

2. Reduce risk of injury from machinery

Consider the following collective means of protection to reduce the risk:

- always ensure there are physical barriers that prevent direct access to machinery;
- due to the nature of the water environments in which mechanical equipment will be utilised, designers should consider the water / weather proofing requirements;
- mechanical interlocking;

3. Control risk of injury from machinery

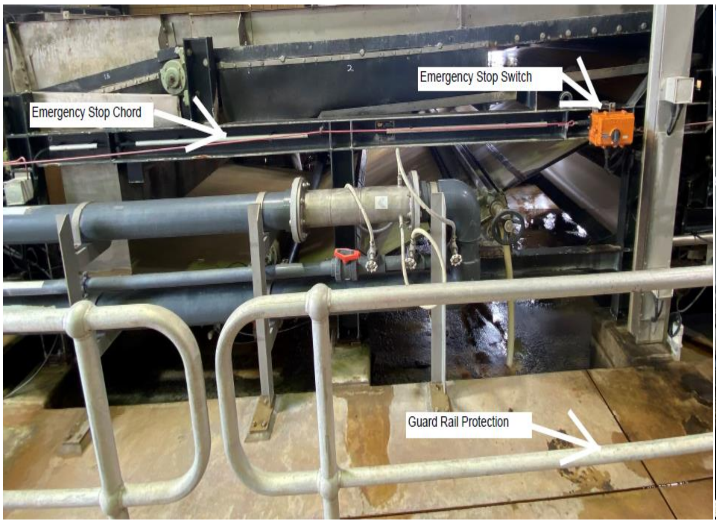
Consider making the interaction between persons and machinery as safe as possible by implementing the following measures:

- for works on existing sites, identify all services likely to cause risk for construction;
- ensure safe access and isolation of all machinery for future operation and maintenance;
- refer to the standards and specifications in Appendix B for more understanding.

Highlight

Protection of operators from working machinery is key to successful SID.

Reduce the Risk with emergence control measures



Control the Risk with fully trained operators

Chapter 11. Cyber Security

Cyber security is as important to consider in the design process as every other chapter in this guideline. Unitywater operates critical infrastructure, and as such is required to comply with the *Security of Critical Infrastructure Act* (SoCI). Where our infrastructure is made digital through connection with technology and applications, cyber security must be designed into the solution to ensure its robustness and ongoing availability.

What is Cyber Security?

Cyber security can be described as: *the collective methods, technologies, and processes to help protect the confidentiality, integrity, and availability of computer systems, networks and data, against cyber attacks or unauthorized access*.

Designers should consider the hierarchy of control methods such as:

1. Do not connect unapproved devices to SCADA networks

By default, all unused ports on the network switches are blocked preventing anyone connecting unapproved devices to the Operations Technology (OT) network. Engineering workstations are the only means to access/program devices on both the controls and SCADA networks. Only approved UW SCADA laptops can connect directly during the commissioning of new equipment, but once commissioned all access needs to be from the engineering workstation.

Least privilege policy is maintained across the OT infrastructure, which limits access rights only to those who absolutely need them. Hence any access to the engineering workstation or issuing of a UW SCADA laptop must be approved by the UW team.

2. Do not introduce new applications into the environment

Only authorized or preferred applications and hardware shall be used in the OT environment. Any new applications or hardware, that are not currently included on the preferred list, require approval by the UW team before being included in the design. For new applications or hardware that are successfully approved and meet all requirements, request that these be incorporated on preferred equipment lists.

3. Apply device hardening

Device hardening can provide a strong first line of defence. Some of the mandatory basic techniques include, but are not limited to:

- replacing all default passwords and keys on each device with strong passwords and randomly generated keys;
- upgrading and implementing the latest security patches before any new software or hardware is commissioned;
- disabling any non-essential services and unnecessary programs (i.e. disabling unused ports on the network switch, disabling features like FTP, Telnet etc.).

4. Apply physical security and tamper protection

Providing physical security for technology devices prevents many cyber security risks by reducing the attack surface of infrastructure. Physical security controls include but are not limited to:

- providing secure housing for devices not located in data centres or secured facilities, such as cabinets;

- providing tamper protection for devices that are generally accessible by unauthorised personnel, such as lockable enclosures, tamper alarms, or physical alarms.

It is strongly recommended to engage with Unitywater team members about appropriate cyber security controls early in the design process.

Highlight

A combination of multiple grades of security architecture and protection is more secure.

Eliminate the Hazard
Avoid simple cyber protection systems that rely on one gate / single access point.

Figure 23. Put hardware (left) and servers (right) in locked cubicles or racks.

Reduce Risk
Implement the full range of security capabilities of products and applications. Limit access control for networks and automation systems.

Control Risk
Require encryption and monitoring of the communication. Implement authentication of both devices and users.

Appendix A - Definitions

Abbreviation	Description
CHAIR	Construction Hazard Assessment Implication Review • CHAIR1 - is performed at the conceptual stage of a design, which is the best opportunity to make fundamental change, even though much of the design is still to be determined. • CHAIR2 - focuses on construction and demolition issues and is performed just prior to construction, when the full detailed design is known. • CHAIR3 - focuses on maintenance and repair issues and is performed at the same time as the CHAIR 2 study.
CHAZOP	Control/Computer HAZOP studies is used to determine the risk level of a plant's Control System or Safety System and typically requires that the control system design meets the requirements set out in the control system functional specification
Code of Practice	A code of practice provides practical guidance for people who have work health and safety duties. These codes give guidance on: • how to achieve the standards required under the Act • effective ways to identify and manage risks. NOTE that from 1 July 2018 persons conducting a business or undertaking are required to comply with an approved code of practice under the QLD Work Health and Safety Act 2011. Alternatively, duty holders can follow another method, such as a technical or an industry standard, to manage hazards and risks, as long as it provides an equivalent or higher standard of work health and safety to the standard required in the code. *https://www.worksafe.qld.gov.au/laws-and-compliance/codes-of-practice*
Contractor / Principal Contractor	The entity bound (including sub-Contractors appointed by the Contractor) to execute the work having responsibility for design, manufacture and supply, delivery, documentation and other functions as further defined in the documents related to the work. *SEQ Water Supply and Sewerage Design & Construction Code*
HA	Hazardous Areas
HAZID	Hazard Identification undertaken at the Design Milestone 1 - Concept or 30%
HAZOP	Hazard and Operability Studies, undertaken at Design Milestone 2 (60%) often revisited at final design review (90%)
Project Documentation	Governing technical documents for the specific items(s) for the specific works included or referenced in the Contract
Design Milestones	Point within a project where progress is verified by the completion of a design activity or a point which marks the start of a design activity. The Designer must submit a complete set of documents applicable to each milestone. The documentation and delivery milestones for the project, are typically - Milestone 1 - Concept Milestone 2 – 30% Design Milestone 3 – 60% Design Development Milestone 5 – 90% Design Acceptance Milestone 6 – 100% Drawings Issued For Construction

Abbreviation	Description
PM	Project Manager
PRR	Project Risk Register
Reasonably Practicable	Reasonably practicable means that which is, or was at a particular time, reasonably able to be done to ensure health and safety, taking into account and weighing up all relevant matters including: • the likelihood of the hazard or the event concerned occurring the degree of harm that might result from the hazard or • the risk what the person concerned knows, or ought reasonably to know, about the hazard or event, and ways of eliminating or minimising the risk • the availability and suitability of ways to eliminate or minimise the risk • after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk. *https://www.worksafe.qld.gov.au/laws-and-compliance/workplace-health-and-safety-laws/definitions*
SFAIRP	Safe Work Australia introduced a model Workplace Health and Safety Act 2011. It places an obligation upon employers and PCBU's to reduce risks to health and safety **so far as is reasonably practicable** (SFAIRP). In conclusion, all duties under the WHS Act are qualified by the term 'reasonably practicable' – Refer definition in this table, above. *https://www.worksafe.qld.gov.au/laws-and-compliance*
WHS	Workplace Health and Safety
PCBU	A person conducting a business or undertaking (PCBU) has a primary duty to ensure the health and safety of workers and others who may be affected by the carrying out of work.

Appendix B - Reference documents

Table 1 – Legislation and Regulations

Legislation and Regulations
Work Health and Safety Act 2011 (Qld);
Work Health and Safety Regulation 2011 (Qld);
Water Supply (Safety and Reliability) Act 2008 (Qld);
Model Planning Scheme Development Code for Hazardous Industries and Chemicals (QLD)
Environmental Protection Act 1994
Environmental Protection Regulation 2008 (Qld) • *Environmental Protection (Air) Policy 2019* • *Environmental Protection (Noise) Policy 2019* • *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*
Building Act 1975 (Qld)
Building Fire Safety Regulation 2008 (Qld)
Electricity Act 1994 (Qld)
Electrical Safety Act 2002 (Qld)
Electricity Regulation 2006 (Qld)
Electrical Safety Regulation 2013 (Qld)
Fire and Emergency Services Act 1990 (Qld)
Professional Engineers Act 2002 (Qld)
Security of Critical Infrastructure Act 2018
Public Health Act 2005 (Qld)
Public Health Regulation 2018 (Qld)

Table 2 – Codes of Practice (Ratified by Legislation)

Codes of Practice (Ratified by Legislation)
South East Queensland Water and Sewerage Design and Construction Code (SEQ WS & S D & C Code) includes the SEQ Asset Information Specification and the SEQ Infrastructure Products and Materials lists (Civil and Mechanical)
The Australian Building Codes Board manages the National Construction Code, and WaterMark Certification Scheme
Refer to the Queensland Department of WorkSafe website for the relevant health and safety related Codes of Practices for design, build, maintain and demolition requirements

Table 3 – Unitywater Safety in Design Documents

Unitywater Safety in Design Documents
Pr8187 - Safety in Design Procedure
F11016 – UW-HAZID Electronic Recording Template
F11017 – UW-HAZOP Electronic Recording Template
F11018 – UW-CHAZOP Electronic Recording Template
F11019 – UW-CHAIR Electronic Recording Template

Table 4 – International and Australian Standards

Standard	Title
AS/NZS ISO 31000	Risk Management - Principles and Guidelines
AS/NZS 4024	Safety of Machinery
AS/NZS 4801	Occupational Health and Safety Management Systems
AS/NZS 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
AS IEC 61511	Functional safety - safety instrumented systems for the process industry sector
AS IEC 61882	Hazards and Operability (HAZOP) studies

Appendix C - Attendance Resource Mapping for Workshops

Team Member	***SID Workshop***				
	HAZID	***HAZOP***	***CHAZOP***	***CHAIR***	***Project Risk Assessment***
Project Manager – UW and Contractor	M	M	M	M	M
Facilitator	M	M	M	M	M
Scribe	M	M	M	M	M
Designer – faculty list below					
Process	M	M	TBA	TBA	TBA
Civil / Structural	M	NR	NR	M	TBA
Mechanical	M	M	NR	M	TBA
Electrical	M	TBA	TBA	M	TBA
Instrumentation and Control Systems	TBA	M	M	TBA	TBA
Independent Technical Specialists					
Process	M	M	TBA	TBA	TBA
Civil / Structural	M	NR	NR	M	TBA
Mechanical	M	M	NR	M	TBA
Electrical	M	TBA	TBA	M	TBA
Instrumentation and Control Systems	TBA	M	M	TBA	TBA
Operations representative (UW)	M	M	M	M	M
Maintenance representative (electrical / mechanical)	M	M	TBA	M	TBA
Health and Safety representative (UW)	M	TBA	TBA	TBA	TBA
Site supervisor (Contractor)	NR	NR	NR	M	TBA
Commissioning Engineers (UW and Contractor)	TBA	TBA	TBA	M	TBA
Environmental representative (UW)	TBA	TBA	TBA	TBA	TBA

KEY

M mandatory attendance at SID workshop

TBA to be advised by UW PM, depending on Project Scope

NR not required